NDVI Analysis of Hail Swaths Associated With the May 5, 1995 Parker County and Tarrant County, Texas Hailstorm

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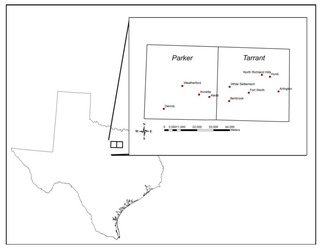
A devastating hailstorm moved through the north Texas counties of Parker and Tarrant on the 5th of May 1995, causing extensive damage to structures and vegetation. Remote sensing techniques using normalized difference vegetation indices (NDVI), image differencing, and change detection were utilized to assess severe hail damage areas associated with this storm. NEXRAD WSR-88D Level II data from the time of the storm were spatially compared to the NDVI classified hail damage swaths. Analysis shows a statistical correlation exists between NEXRAD radar returns and hail damage for the rural areas of Parker County, with no correlation evidenced for the urban areas of Tarrant County. Statistical results indicate that remote sensing NDVI methods are valid for identification of hail swaths in relatively rural areas, but have lesser application for detection in densely populated urban regions; although hail damage areas can be visually identified for parts of the city of Fort Worth. Comparison of the NDVI change detection to in-situ observations of the hail event show that greater negative NDVI change values are indicated in areas that experienced the greatest hail density compared to areas which experienced the largest hail size.



Location of Study Area

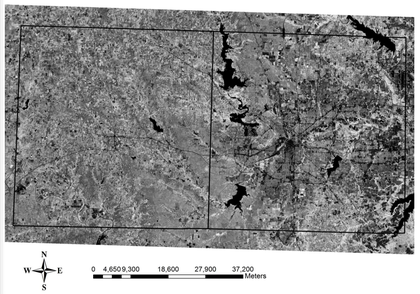
The Purpose of this research is to use remote sensing techniques to analyze the May 5th, 1995 hail damage over Parker and Tarrant counties. The May 5th, 1995 hailstorm event provides a unique opportunity to compare the performance of NDVI change detection techniques for rural and urban areas.

Normalized **D**ifference **V**egetation **I**ndex

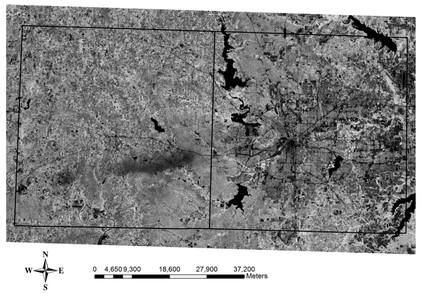
(Infrared - Red)/(Infrared + Red)

for Landsat 5 TM

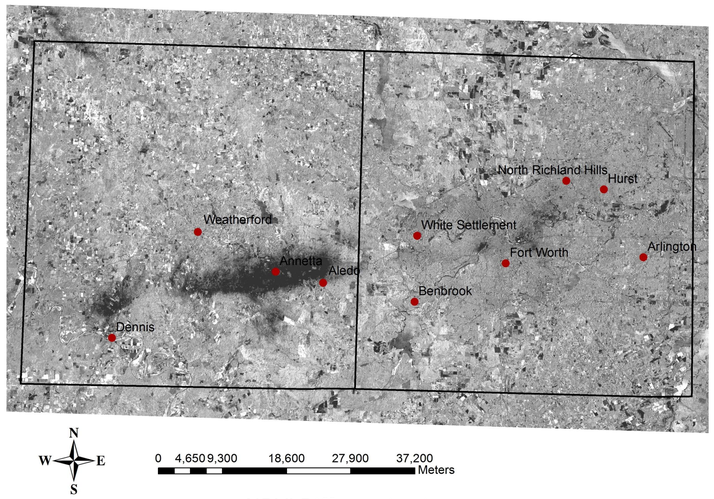
(Band 4 - Band 3)/(Band 4 + Band 3)



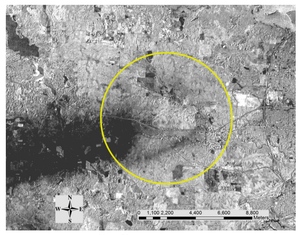
Landsat 5 TM NDVI **April 24th, 1995**



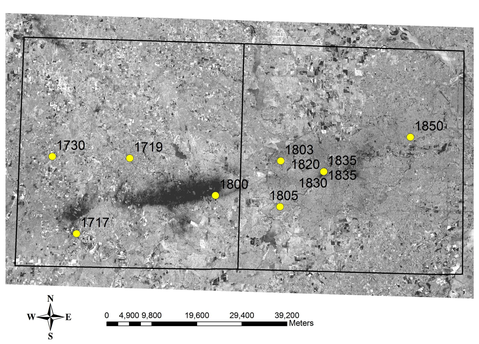
Landsat 5 TM NDVI **May 10th, 1995**



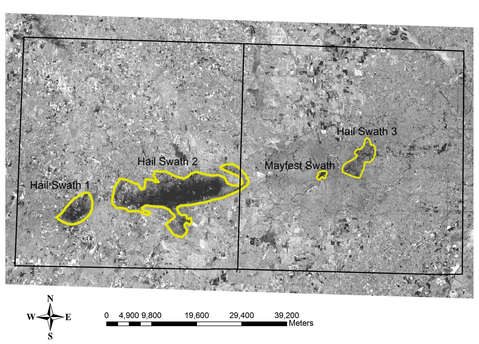
NDVI Differencing image



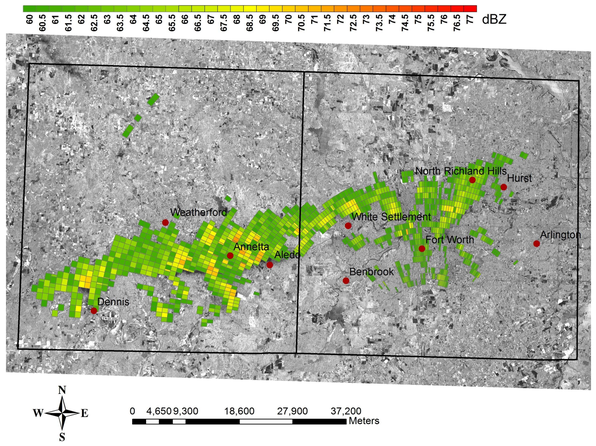
"V" Feature



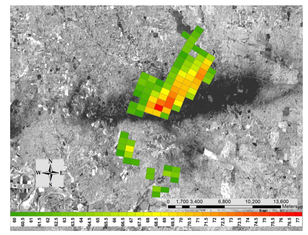
May 5th Hail Reports and Locations



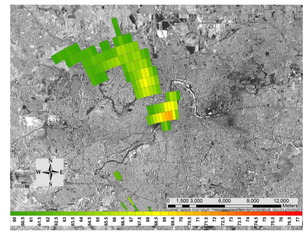
Hail Swaths Identified Via NDVI



Time Composite of KFWS WSR-88D NEXRAD Level II Base Reflectivity Data

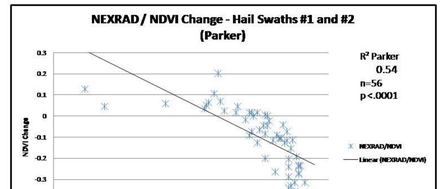


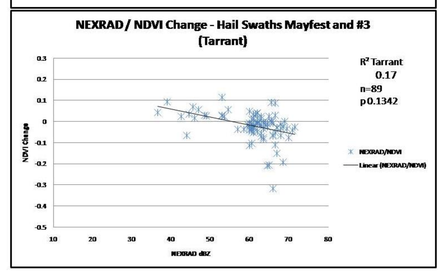
1738 CDT



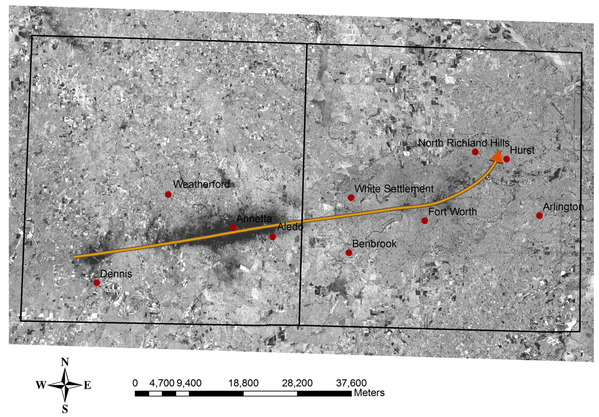
1819 CDT

Time (CDT)	Event
1645	Storm develops just to the west-southwest of Parker County.
1648	Severe thunderstorm warning issued by the National Weather Service office in Fort Worth for Parker County.
1717	4.4 cm hail and thunderstorm wind gust are reported near Dennis in Parker County.
1730	Severe thunderstorm warning expires for Parker County.
1730	4.4 cm hail covering the ground to 45.7 cm deep is reported in Annetta.
1745	Severe thunderstorm warning issued by the National Weather Service office in Fort Worth for Tarrant County.
1800	7 cm hail reported in Aledo.
1805	7 cm hail and wind damage reported in White Settlement and Benbrook.
1808	2.5 cm hail reported at the Carswell Naval Air Station.
1820	8.9 cm hail reported at the Mayfest outdoor festival in Trinity Park, just west of downtown Fort Worth. More than 100 people are injured.
1830	10.2 cm hail reported in downtown Fort Worth. Considerable damage to structures.
1835	3.8 cm hail is observed at the National Weather Service Office location north of downtown Fort Worth.
1835	7 cm hail reported in East Fort Worth.
1835	10.2 cm hail and 65 knot wind gust observed at the KXAS-TV studios in East Fort Worth.
1845	Severe thunderstorm warning expires for Tarrant County.
1846	1.9 cm hail reported in North Richland Hills.
1850	4.4 cm hail reported in Hurst.
1850	2.5 cm hail reported in Redford.
1900	4.4 cm hail and 70 knot winds reported in Arlington in the eastern part of Tarrant County.
~1905	Storm dissipates from hail producing into a heavy rain producer as it moves to the east into Dallas County.





Results show a decrease in vegetative "health" in rural areas near reported storm damage locations. To a lesser extent, the change detection image shows decrease in NDVI near storm damaged urban areas.



Movement of the May 5, 1995 supercell hailstorm as interpreted from the NDVI Differencing image.

References

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Software Used: *ERDAS Imagine* and *ESRI ArcView 9.3*

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